

TIME-SPACE EVOLUTION AND VOLCANOLOGICAL FEATURES OF THE LATE MIOCENE-QUATERNARY CĂLIMANI-GURGHIU-HARGHITA VOLCANIC RANGE, EAST CARPATHIANS, ROMANIA. A REVIEW.

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Abstract

The Carpathian-Pannonian Region (CPR) hosts one of the major Cainozoic volcanic provinces of Europe extending in space over 6 eastern European countries. The lithospheric evolution of this large area governed by large-scale asthenospheric processes is recorded by products of volcanic activity occurred during a time interval of more than 21 million years. According to their surface occurrence areas, ages and composition the Neogene volcanics of CPR were systematized in three main groups: 1) mostly explosive products of felsic magmas generated at the beginning of volcanism in the whole CPR and in their particular occurrence areas (21-12 Ma) developed in the actual intra-Carpathian Pannonian Basin, 2) mostly intermediate calc-alkaline rocks emplaced in both the intra-Carpathian areas and along the arcuate Carpathian fold-and-thrust belt, and 3) Na- and K-alkaline and ultra-alkaline products clustered in a number of monogenetic volcanic fields across the whole intra-Carpathian realm developed in the final stages of volcanic activity of the CPR as a whole and of their particular occurrence areas. The ca. 160 km long Călimani-Gurghiu-Harghita volcanic range (CGH) developed as part of the intermediate calc-alkaline volcanism closely related in space with the fold-and-thrust belt of the Carpathians, representing the south-eastern segment of the CPR. Although its map view and general petrochemical and volcanological characteristics are quite similar with those of other segments of the orogene belt-tied calc-alkaline volcanic segments, at a closer look CGH displays a number of unique features. The time-space evolution of CGH is particular not only in that it is the youngest (10.5 to < 0.05 Ma) dominantly calc-alkaline segment in CPR but also it shows a transient character. Unlike other segments along which volcanism occurred simultaneously forming true subduction-related 400 to 800 km long volcanic fronts which were stable in time for millions of year, in CGH volcanic activity migrated continuously along the

range from NW to SE. So, during any given 1 Ma time interval active volcanism was restricted to very limited areas and to just a few active volcanic centers. The along-range shift of volcanic foci was concurrent with progressively lower volumes of magma erupted and decreasing magma output rates. As a result, gradually lower-volume and less complex volcanic edifices were built up. Moreover, at the range-ending and youngest South Harghita sub-segment, magma compositions gradually changed from normal calc-alkaline to high-K calc-alkaline and shoshonitic, and adakitic features emerged at the end of volcanic activity, after a time gap of 0.5 Ma. This marks a major geodynamic event in the development of the East Carpathians themselves. During the transient volcanism of CGH, edifices of varying volume and complexity were built up forming a row of tightly-packed adjoining stratovolcanoes/composite volcanoes whose peripheral volcanoclastic aprons complexly juxtaposed, overlapped and merged with each other. The largest ones (Călimani caldera, and Fâncel-Lăpușna) developed until caldera stage. Some of them (Rusca-Tihu in the Călimani Mts., Vârghiș in the North Harghita Mts.) became unstable during their growth and collapsed, generating widespread large-volume debris avalanche deposits. Edifice instability was solved by volcano-basement interaction processes, such as volcano spreading, at some large-volume volcanoes (in particular those in the Gurghiu Mts.). Volcano typology changed at the smaller-volume constructs toward the southeastern terminus of the range in the South Harghita Mts. from typical large stratovolcanoes to smaller composite volcanoes, dome clusters and isolated domes and simpler internal structures. As a whole, CGH displays an extremely particular evolutionary pattern strongly suggesting a transient character and decreasing to extinguishing volcanic activity along its length from NW to SE.